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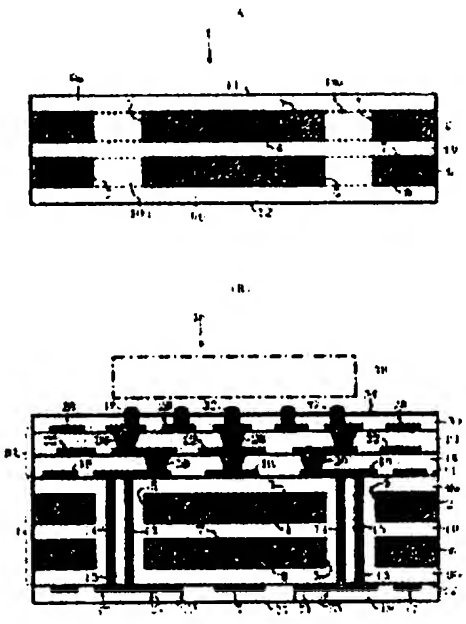
(54) WIRING BOARD AND ITS MANUFACTURING METHOD



(57)Abstract:

PROBLEM TO BE SOLVED: To provide a wiring board which is as high in board strength as required and includes a core board where through-holes can be easily bored and that is provided with a flat front surface and a flat rear surface and to provide a method of manufacturing the same.

SOLUTION: The wiring board 36 comprises the core board 1 comprising metal plates 2 and 6 which are provided with front surfaces 3 and 7 and rear surfaces 4 and 8 and arranged in parallel with each other through an insulating material 10, the through-holes 5 and 5 which are bored in the metal plates 2 and 6 as penetrating through parts between the surfaces 3 and 7 and the rear surfaces 4 and 8 and formed at the same positions in a plan view, and the insulating material 10 filling the through-holes 5 and 5.

[Claim(s)]
[Claim 1]
Two or more metal plates which have the surface and a rear face and have been mutually arranged in parallel via an insulating layer,
A breakthrough which penetrates between the surfaces and rear faces in two or more above-mentioned metal plates,
It has a core substrate containing an insulation material formed in the above-mentioned breakthrough,
A wiring board characterized by things.
[Claim 2]
The wiring board according to claim 1 characterized by what said breakthrough is formed in the almost same position for by plane view in said two or more metal plates.
[Claim 3]
A front wiring layer and a backwiring layer which were individually formed in the surface and a rear face of said core substrate via an outer layer insulating layer, respectively,
A buildup layer which is formed in at least one upper part of the above-mentioned front wiring layer and a backwiring layer, and consists of two or more insulating layers and two or more wiring layers located among these,
The wiring board according to claim 1 or 2 characterized by what is included.
[Claim 4]
A process which inserts an insulation sheet among two or more parallel metal plates which have the surface and a rear face, and is stuck as an insulating layer,
A process of forming a breakthrough along a thickness direction of a layered product which consists of the above-mentioned insulating layer inserted between two or more above-mentioned metal plates and these,
Laminate an outer layer insulation sheet at the surface and a rear face of the above-mentioned layered product, respectively, these are pressed and stuck along a thickness direction, and a manufacturing process of a core substrate provided with a process of filling up the above-mentioned breakthrough with an insulation material is included,
A manufacturing method of a wiring board characterized by things.
[Claim 5]
A process of forming a breakthrough in the same position by plane view in two or more metal plates which have the surface and a rear face,
A process of forming a layered product containing an insulation material with which an insulating layer and the above-mentioned breakthrough which are stuck among two or more metal plates by inserting an insulation sheet among two or more parallel above-mentioned metal plates which have the above-mentioned breakthrough, and pressing these along a thickness direction were filled up,
A process of sticking an outer layer insulation sheet to the surface and a rear face of the above-mentioned layered product, respectively,

A manufacturing method of a wiring board characterized by what a manufacturing process of a core substrate is included for.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

This invention relates to a wiring board using the core substrate which has a core material (core material) of a metal plate, and a manufacturing method for the same.

[0002]

[Description of the Prior Art]

In the wiring board of the multilayer structure containing two or more insulating layers and two or more wiring layers located among these, they are a product made of resin, or resin. - The core substrate which has glass insulation is used. However, in order to raise the intensity of a wiring board and to prevent modification of curvature etc., the core substrate which has a metal plate which consists of copper alloys, for example is also utilized.

These metal core substrates 60 consist of the insulation material 66 etc. which consist of the breakthrough 65 which consists of copper alloys and penetrates between the 0.25-mm-thick metal plate 62, and its surface 63 and rear face 64, and a synthetic resin with which it filled up in this breakthrough 65, as shown in drawing 6(A). The insulating layers 66a and 66b which consist of synthetic resins are individually formed in the surface 63 and the rear face 64 of the above-mentioned metal plate 62.

[0003]

When thinking as important heat dissipation nature, and the working current value and substrate strength of a wiring board, the comparatively heavy-gage metal plate 62 is used. However, as shown in drawing 6(B), when punching the breakthrough 65 between the surface 63 of this metal plate 62, and the rear face 64, the ratio (aspect ratio) of the length of the shaft orientations of this breakthrough 65 and an inside diameter becomes large. For this reason, there was a problem that exact formation of the breakthrough 65 by a drill etc. became difficult.

On the other hand, it corresponds to a miniaturization and thinning, or the metal plate 62 of thin meat is comparatively used in the core substrate 60 of the wiring board which thinks as important reduction of the loop inductance in the through hole conductor which penetrates an inside. However, when the core substrate 60 which has the metal plate 62 of thin meat was used, there was a problem that substrate strength fell.

[0004]

As shown in drawing 6(C), the wiring board 70 by which only the surface 67 side of the core substrate 60 formed the buildup layer BU in (one side) has the following structures.

The above-mentioned wiring board 70 forms the through hole conductor 72 and the filling resin 73 in the through hole 71 which penetrates the inside of the breakthrough 65 of the metal plate 62 in the core substrate 60 via the

insulation material 66, as shown in drawing 6(C). The front wiring layer 74 and the backwiring layer 75 are individually formed in the surface 67 and the rear face 68 of the core substrate 60. The buildup layer BU has the insulating layers 76 and 82 which consist of resin, and the wiring layers 80 and 86 formed in between at these, the wiring layer 80 is connected with the front wiring layer 74 via the beer conductor 78, and it is connected by the beer conductor 84 between the wiring layers 80 and 86.

[0005]

As shown in drawing 6(C), two or more solder bumps 92 which the insulating layer (solder resist layer) 88 of the top layer is formed on the insulating layer 82 and the wiring layer 86, and are set up from the wiring layer 86 penetrated the insulating layer 88, and have projected it more highly than the surface 90. As shown in drawing 6(C), the insulating layer (solder resist layer) 79 is formed also under the rear face 68 of the core substrate 60, and the backwiring layer 75, and the wiring 77 prolonged from the backwiring layer 75 is located in two or more openings 83 which carry out an opening to the surface 81.

[0006]

However, since the quantity of the wiring board 70 of the insulation material 66 with which this inside is filled up will increase if the metal plate 62 in the core substrate 60 is heavy-gage and the breakthrough 65 becomes long, A dent arises at the surface 67 and the rear face 68 of the core substrate 60 which are located right above this breakthrough 65 and in right under, and there is a problem that surface smoothness, such as the wiring layer 74 formed on these, is not obtained. When the breakthrough 65 becomes long, there is a problem that the loop inductance of the through hole conductor 72 which penetrates this increases.

In addition, since resin was unevenly distributed in the built-up layer BU side and metal was unevenly distributed in the core substrate 60 side, as the alternate long and short dash line in drawing 6(C) showed, there was also a problem of becoming easy to produce the curvature that the wiring board 70 whole is dented in the buildup layer BU side.

[0007]

[Problem(s) to be Solved by the Invention]

This invention solves the problem in the Prior art explained above, and makes problem what a wiring board which exists high substrate strength including the core substrate which has the surface that punching is easy and flat and rear face of a breakthrough, and a manufacturing method for the same are provided for.

[0008]

[The means for solving a technical problem and an effect of the invention]

This invention is hit on an idea of it and accomplished to what two or more metal plates of thin meat are comparatively used for a core substrate for in order to solve an aforementioned problem.

Namely, two or more metal plates which the wiring board (Claim 1) of this invention has the surface and a rear face, and have been mutually arranged in

parallel via an insulating layer, It has the core substrate containing the breakthrough which penetrates between the surfaces and the rear faces in two or more of these metal plates, and the insulation material formed in this breakthrough.

[0009]

According to this, since two or more metal plates of thin meat can be used comparatively, an accurate breakthrough is formed between those surfaces and rear faces, and maintaining at a desired level becomes easy [the intensity of the wiring board which does not reduce the intensity of the core substrate concerned and contains this core substrate]. Compared with the wiring board containing the core substrate which has the conventional metal plate of one sheet, and this, it also becomes possible to carry out a weight saving. Compared with the case where the comparatively heavy-gage metal plate of one sheet is used for a core substrate, the processability at the time of formation of a breakthrough improves.

[0010]

If it adds, it is also possible by making different the characteristics, thickness, etc., such as a coefficient of thermal expansion of two or more above-mentioned metal plates, to control the curvature resulting from the internal structure of the wiring board which has multilayer structure, or to also cancel, and to consider it as an easy wiring board.

To said metal plate, copper alloys, such as Cu-2.3wt%Fe-0.03wt%P (194 alloys), Fe-nickel system alloys, such as pure copper, oxygen free copper, Fe-42wt%nickel (42 alloys), and Fe-36wt%nickel (Invar), other steel types, titanium and its alloy, and the board that consists of aluminum, its alloy, etc. are contained. The above "it is light-gage comparatively" refers to that it is thinner than 0.25 mm in thickness of the conventional metal plate, for example.

[0011]

The wiring board (Claim 2) currently formed in the almost same position by plane view [in / in said breakthrough / said two or more metal plates] is also contained in this invention.

According to this, since the breakthrough of two or more metal plates is located mostly in a coaxial core, it becomes possible to be able to arrange a through hole conductor with sufficient accuracy along these central parts, and to stabilize electrical properties, such as the insulation of the circumference of this through hole conductor. Therefore, it becomes possible to have necessary substrate strength and surface smoothness, and to consider it as a reliable wiring board.

[0012]

The front wiring layer and backwiring layer which were formed in the surface and the rear face of said core substrate at this invention, The wiring board (Claim 3) which contains further the buildup layer which consists of two or more insulating layers formed in at least one upper part of this front wiring layer and a backwiring layer and two or more wiring layers located among

these is also contained.
According to this, it can be considered as the wiring board of the multilayer structure which has necessary substrate strength and display flatness. For example, by the wiring board of the one side structure which forms the above-mentioned buildup layer only above the surface of a core substrate. By making different two or more coefficients of thermal expansion, thickness, etc. of a metal plate which are contained in a core substrate, the curvature in which the buildup layer side is dented is canceled or controlled, and it becomes easy [also considering it as a wiring board with high reliability which has a buildup layer containing much more flat wiring layer and insulating layer and the flat surface and a backwiring layer].
[0013]
This invention may contain the wiring board by which the through hole conductor which connects said front wiring layer and a backwiring layer is formed in the breakthrough of said core substrate.
When based on this, the above-mentioned through hole conductor can penetrate the breakthrough of two or more of said metal plates via an insulation material, and can take certainly the conduction between a front wiring layer and a backwiring layer. For this reason, it becomes possible to carry out conduction of two or more wiring layers which can be set to the buildup layer formed in either [at least] the surface of a core substrate, or a rear face to the backwiring layer of the opposite hand of a core substrate, or a front wiring layer, or to take certainly the conduction of the build-up wiring which sandwiched the core substrate.
[0014]
On the other hand, the manufacturing method (Claim 4) of the 1st wiring board in this invention, The process which inserts an insulation sheet among two or more parallel metal plates which have the surface and a rear face, and is stuck as an insulating layer, The process of forming a breakthrough along the thickness direction of the layered product which consists of the above-mentioned insulating layer inserted between two or more above-mentioned metal plates and these, Laminate an outer layer insulation sheet at the surface and the rear face of the above-mentioned layered product, respectively, these are pressed and stuck along a thickness direction, and the manufacturing process of a core substrate provided with the process of filling up the above-mentioned breakthrough with an insulation material is included.
According to this, the above-mentioned breakthrough can be formed in two or more metal plates with sufficient accuracy, this breakthrough can be filled up with an insulation material the neither more nor less, and the core substrate which has necessary intensity, and the wiring board which have the desired substrate strength and surface smoothness using this and where an electrical property is stabilized easily can be manufactured certainly.
[0015]
The manufacturing method (Claim 5) of the 2nd wiring board in this invention, By inserting an insulation sheet between the process of forming a

breakthrough in the same position, and two or more above-mentioned parallel metal plates which have the above-mentioned breakthrough by the plane view in two or more metal plates which have the surface and a rear face, and pressing these along a thickness direction, The manufacturing process of a core substrate provided with the process of forming the layered product containing the insulation material with which the insulating layer and the above-mentioned breakthrough which are stuck among two or more metal plates were filled up, and the process of sticking an outer layer insulation sheet to the surface and the rear face of this layered product, respectively is included.
Also by this, form the above-mentioned breakthrough in two or more metal plates with sufficient accuracy, and this breakthrough is filled up with an insulation material the neither more nor less, and it becomes possible to manufacture certainly the core substrate of necessary intensity, and the wiring board using this which are flat and where an electrical property is stabilized easily.
[0016]
This invention may also contain the manufacturing method of a wiring board which has the process of forming the through hole and through hole conductor which are in the breakthrough of the above-mentioned layered product, and penetrate the above-mentioned insulating layer, a surface insulating layer, and a rear-face insulating layer after said each process.
Since a through hole conductor can be arranged with sufficient accuracy along the central part of the breakthrough of two or more metal plates when based on this, it becomes possible to manufacture the wiring board which has necessary substrate strength and was excellent in electrical properties, such as the insulation of the circumference of the above-mentioned through hole conductor.
[0017]
[Mode for carrying out the invention]
Below, the suitable form for enforcement of this invention is explained with Drawings.
Drawing 1 (A) shows the section of the core substrate 1 of one form in this invention.
As shown in drawing 1 (A), the core substrate 1 The metal plates (core material) 2 and 6 of a couple (plurality), The insulating layer 10 which intervenes among these, and two or more breakthroughs 5 which penetrate between the surfaces 3 and 7 of the metal plates 2 and 6, and the rear faces 4 and 8, It has the insulation materials 10a and 10b with which it filled up in this breakthrough 5, the surface insulating layer (outer layer insulating layer) 9a formed in the surface 3 of the metal plate 2, and the rear-face insulating layer (outer layer insulating layer) 9b formed in the rear face 8 of the metal plate 6.
The above-mentioned metal plates 2 and 6 consist of a copper alloy of Cu-2.3wt%Fe-0.03wt%P (194 alloys), and the thickness is thin meat comparatively

compared with 0.1 mm and the former.

[0018]

the above-mentioned breakthrough 5 -- a round cross section -- and -- the inside diameter is about 0.3 mm -- the above-mentioned metal plates 2 and 6 -- punching and a drill -- or it is etched and formed. Two or more breakthroughs 5 and 5 are formed in the same position by plane view, as shown in drawing 1 (A). The above-mentioned insulating layer 10, the insulation materials 10a and 10b, the surface insulating layer 9a, and the rear-face insulating layer 9b consist of epoxy resins, for example. Among these, the thickness of the insulating layer 10, and the surface and rear-face insulating layers 9a and 9b is about 20-40 micrometers.

That is, the thickness of the whole between the surface 11 and rear face 12 is about 0.3 mm, and the processability of the core substrate 1 shown in drawing 1 (A) of the above-mentioned breakthrough 5 improves.

[0019]

Since it is a laminated structure which consists of the metal plates 2 and 6 of the couple of thin meat, the insulating layer 10 arranged among these, and the surface and the rear-face insulating layers 9a and 9b which were formed in surface 3 and the rear face 8 of the above-mentioned metal plates 2 and 6 comparatively according to the above core substrates 1, Intensity does not fall compared with the core substrate 60 using the single metal plate 62 like before. Since the breakthrough 5 comparatively smooth in a wall to the metal plates 2 and 6 of thin meat is formed, it fills up with the insulation materials 10a and 10b the neither more nor less in this breakthrough 5 and 5. And since the quantity of the insulation materials 10a and 10b with which the breakthroughs 5 and 5 are filled up becomes less conventionally, it becomes difficult to produce a dent at the surface 11 and the rear face 12 of the core substrate 1 of [the / right above or right under], and the wiring layer and insulating layer which are formed in these upper parts later on can be made flat, and can be formed.

[0020]

Drawing 1 (B) shows the section of the wiring board 36 which used said core substrate 1.

The through hole conductor 14 in alignment with the through hole 13 which penetrates the central part etc. of the core substrate 1 and the insulation materials 10a and 10b located in the breakthrough 5 and 5 as the wiring board 36 is shown in drawing 1 (B), and its wall, The front wiring layer 16 and the backwiring layer 17 which were individually formed in the surface 11 and the rear face 12 of the core substrate 1 are included. Said metal plates 2 and 6 can also be used as a power supply or a ground layer by conducting via the front wiring layer 16, the backwiring layer 17, and the beer conductor that is not illustrated.

An outer diameter is about 150 micrometers, and thickness is about 20 micrometers, and the above-mentioned through hole conductor 14 is connected with the front wiring layer 16 and the backwiring layer 17 in the upper [its]

and lower end. This front wiring layer 16 and the backwiring layer 17 have a prescribed pattern, and consist of an about 10-40-micrometer-thick coppering film.

[0021]

As shown in drawing 1(B), the buildup layer BU which consists of the wiring layers 22 and 28 formed in the insulating layers 18 and 24, and between these and the surface is formed above the surface 11 of the core substrate 1, and the front wiring layer 16. The above-mentioned insulating layers 18 and 24 consist of an epoxy resin film in which thickness contains inorganic fillers, such as a silica filler, at 30 micrometers. The above-mentioned wiring layers 22 and 28 have a prescribed pattern, and consist of the coppering film as the above with same thickness. It is connected via the beer conductors (filled via) 20 and 26 which consist of copperings between these wiring layers 22 and 28 and between the front wiring layer 16 and the wiring layer 22. On the above-mentioned insulating layer 24 and the wiring layer 28, the 20-micrometer-thick insulating layer (solder resist layer) 30 is formed.

[0022]

As shown in drawing 1(B), from the proper place of the above-mentioned wiring layer 28, the insulating layer 30 was penetrated and two or more solder bumps 32 higher than the 1st principal surface 34 that is the surface have projected. The solder bump 32 consists of low melting alloys, such as a Sn-Ag system, a Pb-Sn system, a Sn-Ag-Cu system, a Sn-Cu system, and a Sn-Zn system (this embodiment Sn-Ag system), and is individually connected with the contact button which IC chip (electronic parts) 38 mounted on the 1st principal surface 34 does not illustrate. The solder bump 32 and the contact button of IC chip 38 are laid underground by the underfill material which is not illustrated, and are protected.

[0023]

As shown in drawing 1(B), on the other hand, under the rear face 12 of the core substrate 1, and the backwiring layer 17 (upper part), Said same insulating layer (solder resist layer) 19 is formed, and the wiring 21 prolonged from the backwiring layer 17 is located in the bottom of the opening 23 which carries out an opening to the 2nd principal surface 25 side in this insulating layer 19. Nickel plating and Au plating are covered by the surface, and this wiring 21 is utilized as a contact button with printed circuit boards, such as a mother board to illustrate.

[0024]

Since the metal 2 and 6 of a couple is arranged in parallel and is in the core substrate 1 with thin meat comparatively in the above wiring boards 36, have the same substrate strength as usual, and. Since the breakthrough 5 is formed with sufficient accuracy, the insulation materials 10a and 10b are made dense, and the inside is filled up, and the circumference of the through hole conductor 14 can be insulated certainly. Since the surface 11 of the core substrate 1 is flat, it becomes easy to secure surface smoothness formed in this upper part, such as the front wiring layer 16 etc. and the insulating layer 18. Since the

through hole conductor 14 has penetrated the thin core substrate 1 which contains the metal 2 and 6 of thin meat comparatively, compared with the case where the conventional thick metal plate of one sheet is used, the length of this through hole conductor 14 becomes short about several 10 micrometers. As a result, the loop inductance by the current which flows through the through hole conductor 14 can be reduced, and an electrical property can be stabilized. Therefore, it has the same intensity as usual, and a weight saving is also possible, internal wiring etc. are flat, and it becomes the wiring board 36 where an electrical property is stabilized easily.

[0025]

Below, the manufacturing method of said wiring board 36 is explained. Drawing 2 is related with the manufacturing method (Claim 4) of the 1st wiring board 36 in this invention. Drawing 2 (A) consists of said copper alloy, and inserts 60-micrometer-thick insulation sheet S between 0.1-mm-thick the rear face 4 of the metal plates 2 and 6 of a couple and the surface 7, and shows the process pressed and stuck along these thickness directions. The dry type film which consists of epoxy resins, for example is used for above-mentioned insulation sheet S.

Next, as shown in drawing 2 (B), the process of forming two or more breakthroughs 5 0.3 mm in inside diameter and h by a drill or punching is performed along a thickness direction with the layered product which consists of the metal plates 2 and 6 and insulation sheet S. Under the present circumstances, as for the metal plates 2 and 6, since each thickness is 0.1 mm and thin meat, the above-mentioned breakthrough 5 and h which penetrate these become a cutting surface or a torn surface comparatively smooth in that wall with that sufficient accuracy of position.

[0026]

Subsequently, as shown in drawing 2 (C), 60 micrometers-thick said same outer layer insulation sheet S1 and S2 are individually laminated at the surface 3 and the rear face 8 of the layered product which consists of the metal plates 2 and 6 and insulation sheet S which have two or more breakthroughs 5 and h. And the process pressed heating the metal plates 2 and 6, insulation sheet S and the outer layer insulation sheet S1, and S2 with a hotpress etc. along a thickness direction as the arrow in drawing 2 (C) shows is performed. Publicly known hardening (cure) processing which heats and stiffens above-mentioned insulation sheet S, S1, and S2 after this process is performed.

As a result, as shown in drawing 2 (D), above-mentioned insulation sheet S, S1, and S2 are compressed in a thickness direction, and it presses fit and fills up with those parts in the breakthrough 5 and 5 of the metal plates 2 and 6, and becomes the insulation materials 10a and 10b. Simultaneously, above-mentioned insulation sheet S, S1, and S2 become the insulating layer 10 mutually connected to one, and the surface and rear-face insulating layers 9a and 9b, and as shown in drawing 2 (D), said core substrate 1 which builds in the metal plates 2 and 6 is obtained. In this core substrate 1, since the insulation materials 10a and 10b with which two or more breakthroughs 5 are

filled up decrease in number, it becomes difficult to produce a dent at the surface 11 and the rear face 12 of the right above and right under. That is, since [that the length of the breakthrough 5 is short] the cure shrinkage of resin is small, a dent decreases.

[0027]

Drawing 3 is related with the manufacturing method (Claim 5) of the 2nd wiring board 36 in this invention. Drawing 3 (A) consists of said copper alloy, and shows the process which formed the breakthrough 5 0.3 mm in inside diameter in the same position between the surfaces 3 and 7 and the rear faces 4 and 8 in plane view by two or more punching to the metal plates 2 and 6 of the same thickness as the above. Since these metal plates 2 and 6 are thin meat comparatively, respectively, the above-mentioned breakthrough 5 which penetrates these serves as a punching side comparatively smooth in the wall with the sufficient accuracy of position.

Next, as shown in drawing 3 (B), 80-micrometer-thick insulation sheet S is inserted between the rear face 4 of the metal plates 2 and 6 and the surface 7 in which the breakthrough 5 was formed, and as the arrow in the figure shows, the process pressed with a hotpress along these thickness directions is performed.

[0028]

As a result, as shown in drawing 3 (C), insulation sheet S becomes thin, and the part Sa and Sb are simultaneously pressed fit in the breakthrough 5 and 5 of the metal plates 2 and 6, and these are filled mostly. Thereby, the metal plates 2 and 6 and insulation sheet S become the stuck layered product.

Subsequently, as shown in drawing 3 (D), 40 micrometers-thick said same outer layer insulation sheet S1 and S2 are individually laminated at the surface 3 and the rear face 8 of the layered product which consists of the metal plates 2 and 6 and insulation sheet S. And the process pressed heating the metal plates 2 and 6, insulation sheet S and the outer layer insulation sheet S1, and S2 with a hotpress along a thickness direction as the arrow in drawing 3 (D) shows is performed. Publicly known hardening (cure) processing which heats and stiffens above-mentioned insulation sheet S, S1, and S2 after that is performed. As a result, the same core substrate 1 can be obtained with having been shown in said drawing 1 (A) and 2 (D).

[0029]

A drill or laser beam machining is performed along the thickness direction of the insulating layer 10 located between the central part of the breakthroughs 5 and 5 of the metal plates 2 and 6 in the core substrate 1 obtained by said 1st or 2nd manufacturing method, and these, or the up-and-down surface and rear-face insulating layers 9a and 9b. As a result, as shown in drawing 4 (A), the through hole 13 about 150 micrometers in inside diameter is formed along the central part of the breakthroughs 5 and 5 of the metal plates 2 and 6.

All over the wall of the above-mentioned through hole 13, the surface 11 of the core substrate 1, and the rear face 12, plating catalysts, such as Pd, are covered and non-electrolytic copper plating and electrolytic copper plating are

performed. As a result, as shown in drawing 4 (B), in accordance with the wall of the through hole 13, the through hole conductor 14 of a cylindrical shape is mostly formed for thickness at about 20 micrometers, and the coppering films 11a and 12a are formed all over the surface 11 of the core substrate 1, and the rear face 12.

[0030]

Next, it is filled up with the filling resin 15 which is non-conducting or conductivity and contains an inorganic filler inside the above-mentioned through hole conductor 14 as shown in drawing 4 (C). Coppering of the upper and the lower end of the above-mentioned filling resin 15 is carried out, and lid plating is carried out.

Subsequently, the etching resist which has a predetermined pattern and which is not illustrated is formed on the above-mentioned coppering films 11a and 12a, respectively, and the coppering films 11a and 12a exposed from the crevice between these resists are etched by a publicly known method.

As a result, as shown in drawing 4 (C), the front wiring layer 16 and the backwiring layer 17 which imitated the above-mentioned pattern are formed in the surface 11 and the rear face 12 of the core substrate 1, and these are mutually connected to them via the through hole conductor 14.

[0031]

After this, above the surface 11 of the core substrate 1, and the front wiring layer 16, the insulating layers 18 and 24, the solder resist layer 30, the wiring layers 22 and 28, and the filled beer conductors 20 and 26 which form said buildup layer BU -- a publicly known build-up process (a semiadditive process.) It forms with formation of the insulating layer by the lamination of a fully-additive process, a subtractive process, and film-like-resin material, photolithography technique, etc. Said solder bump 32 is formed in the proper place on the wiring layer 28.

[0032]

Said solder resist layer 19 is formed above the rear face 12 of the core substrate 1, and the backwiring layer 17 (lower part), laser beam machining is performed to this, and said opening 23 is formed, and the wiring 21 is exposed on the bottom, and said plating is performed to the surface.

As a result, the wiring board 36 of this invention shown in said drawing 1 (B) can be obtained. According to the manufacturing method of the 1st and 2nd wiring boards 36 in above this inventions, the wiring board 36 which uses said core substrate 1 and has necessary substrate strength and display flatness and where an electrical property is stabilized easily can certainly be provided.

The same buildup layer BU as the above may be symmetrically formed also above the rear face 12 of the core substrate 1, and the backwiring layer 17.

[0033]

Drawing 5 (A) shows the section of the core substrate 1a which is an application form of said core substrate 1.

The core substrate 1a is provided with the following.

The metal plate 6a whose metal plate 2a whose thickness which consisted of

said copper alloy and has been mutually arranged in parallel as shown in drawing 5 (A) is 0.12 mm and thickness are 0.08 mm.
The same insulating layer 10 as the above located among these.
As shown in drawing 5 (A), in said two or more same breakthroughs 5 that penetrate the same position by plane view between the surfaces 3 and 7 of the above-mentioned metal plates 2a and 6a, and the rear faces 4 and 8, It fills up with the same insulation materials 10a and 10b as the above, and the same surface insulating layer 9a as the above and the rear-face insulating layer 9b are formed also in the surface 3 of the metal plate 2a, and the rear face 8 of the metal plate 6a. This core substrate 1a can also be obtained with said 1st or 2nd manufacturing method.
[0034]
Said similar intensity, surface smoothness, etc. are obtained also by the above-mentioned core substrate 1a. And since the heavy-gage metal plate 2a is arranged relatively to surface 11 slippage of the core substrate 1a, It also becomes possible to abolish the curvature that the buildup layer BU side concerned is dented also as said wiring board 36 in which said buildup layer BU was formed only on the surface 11 of the core substrate 1a concerned (on one side), and same wiring board, or to control.
Also in said core substrate 1 using the metal plates 2 and 6 of the same thickness, prevention of the above-mentioned curvature is attained also by selecting a large thing from the coefficient of thermal expansion of the metal plate 6 of rear-face 12 slippage in the coefficient of thermal expansion of the metal plate 2 of surface 11 slippage of this core substrate 1.
[0035]
Drawing 5 (C) shows the section of the core substrate 40 of a different form. The core substrate 40 contains the metal plates 41, 44, and 47 whose thickness which consisted of said copper alloy and has been arranged in parallel mutually is 0.08 mm, and the insulating layers 51 and 52 arranged among these, as shown in drawing 5 (C). To the metal plates 41, 44, and 47, two or more breakthroughs 50 have penetrated between the surfaces 42, 45, and 48 and the rear faces 43, 46, and 49 in the same position in the coaxial core by plane view. It fills up with said same insulation material in each breakthrough 50, and the surface insulating layer (outer layer insulating layer) 53 and the rear-face insulating layer (outer layer insulating layer) 54 are individually formed in the surface 42 of the metal plate 41 of the top layer, and the rear face 49 of the metal plate 47 of the bottom of the heap. The thickness of the whole between the surface 55 of this core substrate 40 and the rear face 56 is the same as the thickness of said core substrates 1 and 1a almost.
Can also obtain the above core substrates 40 with said 1st or 2nd manufacturing method, and the same effect as said core substrate 1 is acquired, and it is possible to form said wiring board 36 and the same wiring board.
[0036]
Drawing 5 (C) shows the section of the application form slack core substrate

40a of the above-mentioned core substrate 40. The core substrate 40a contains the metal plates 41a, 44, and 47a of three sheets which consisted of said copper alloy and have been arranged in parallel mutually, as shown in drawing 5 (C). As for the thickness of the metal plate 41a of the top layer, the thickness of the metal plate 47a of 0.08 mm and the bottom of the heap of the thickness of 0.10 mm and the medium-rise metal plate 44 is 0.05 mm. Between the metal plates 41a and 44 and 47a, the same insulating layers 51 and 52 as the above are located, and said same breakthrough 50 is formed between these surfaces 42, 45, and 48 and rear faces 43, 46, and 49.
The same surface insulating layer 53 as the above and the rear-face insulating layer 54 are individually formed in the surface 42 of the metal plate 41a of the top layer, and the rear face 49 of the bottom of the heap.
[0037]
Said similar intensity, surface smoothness, etc. are obtained also by the above-mentioned core substrate 40a. And since the heavy-gage metal plate 41a is arranged as relatively as surface 55 slippage of the core substrate 40a and the metal plate 47a of thin meat is arranged as relatively as rear-face 56 slippage, It also becomes possible to abolish the curvature that this buildup layer BU side is dented also as said wiring board 36 in which said buildup layer BU was formed only on the surface 55 of the core substrate 40a concerned (on one side), and same wiring board, or to control.
Also in said core substrate 40 using the metal plates 41, 44, and 47 of the same thickness, Prevention of the above-mentioned curvature is attained also by making the coefficient of thermal expansion of the metal plate 41 of surface 55 slippage of this core substrate 40 larger than the coefficient of thermal expansion of the metal plate 47 of rear-face 56 slippage, and selecting the coefficient of thermal expansion of the medium-rise metal plate 44 to these middle things.
[0038]
This invention is not limited to each form explained above.
Fe-nickel system alloys, such as pure copper, oxygen free copper and Fe-42wt%nickel, and Fe-36wt%nickel besides said copper alloy, other steel types, titanium and its alloy and aluminum, and its alloy are also applicable to the metal plate 2,6 in each form. And to the core substrate 1, it is also possible to use together the metal plate of four or more sheets.
It is also possible to apply the prepreg etc. of the composite which impregnated the epoxy resin to continuation porosity PTFE to the insulation material which becomes said insulating layer 10, the surface, rear-face insulating layers 9a and 9b, etc.
To the insulating layer 18 of the buildup layer BU. The polyimide resin which has the same heat resistance, a pattern moldability, etc. besides what uses said epoxy resin as the main ingredients, BT resin, PPE resin, Or the composite material etc. of the resin-resin system which made fluororesin of the three-dimensional network structures, such as PTFE which has a continuation stoma, impregnate resin, such as an epoxy resin, can also be used. The method

of applying liquefied resin besides the method of bonding an insulating resin film by thermo-compression by a roll coater can also be used for formation of an insulating layer. The presentation of the woven glass fabric or glass filler mixed in an insulating layer is good again also as what used together two or more of kinds of any of E glass, D glass, Q glass, and S glass, or these.

[0039]

It is good for the front wiring layer 16 or the wiring layer 22 of the buildup layer BU as for the Ag, nickel, and nickel-Au system etc. besides said Cu (copper), or may form in them by the method of applying conductive resin not using the metal skin of these metal. It can change to said filled beer conductor 20, and the inside of a via hole formed in the insulating layer 18 etc. can also use the conformal beer conductor of the reverse conical shape which has not been thoroughly buried with the conductor. Or it is good also as a form between which it is placed by the wiring layer which the form of SUTAGGADO accumulated shifting the axial center of each beer conductor may be sufficient as, and is prolonged in a plane direction on the way.

[Brief Description of the Drawings]

[Drawing 1]As for (A), (B) is a sectional view showing one form of the core substrate used for the wiring board of this invention, and a sectional view showing the wiring board of this invention which used this core substrate.

[Drawing 2](A) - (D) is a schematic view showing each process of the manufacturing method of the 1st wiring board.

[Drawing 3](A) - (D) is a schematic view showing each process of the manufacturing method of the 2nd wiring board.

[Drawing 4](A) - (C) is a schematic view showing each process of following the process of the end of each above-mentioned manufacturing method.

[Drawing 5]As for the sectional view showing the application form of the core substrate of drawing 1 (A), and (B), in (A), (C) is a sectional view showing the core substrate of a different form, and a sectional view showing the application form of the core substrate of (B).

[Drawing 6]As for the sectional view showing the conventional core substrate, and (B), in (A), (C) is a sectional view showing the metal plate used for this, and a sectional view showing the conventional wiring board which used the core substrate of (A).

[Explanations of letters or numerals]

1, 1a, 40, 40a ..... Core substrate
2, 2a, 6, 6a, 41, 44, 47 -- Metal plate
3, 7, 42, 45, 48 ..... The surface of a metal plate
4, 8, 43, 46, 49 ..... Rear face of a metal plate
5,50.....Breakthrough
9a,53.....Surface insulating layer (outer layer insulating layer)
9b,54.....Rear-face insulating layer (outer layer insulating layer)
10, 51, 52 ..... Insulating layer
10a, 10b ..... Insulation material
11,55.....The surface of a core substrate

12,56.....The rear face of a core substrate
16.....Front wiring layer
17.....Backwiring layer
18,24.....Insulating layer
22,28.....Wiring layer
36.....Wiring board
BU.....Buildup layer
S.....Insulation sheet
S1,S2.....Outer layer insulation sheet
h.....Breakthrough

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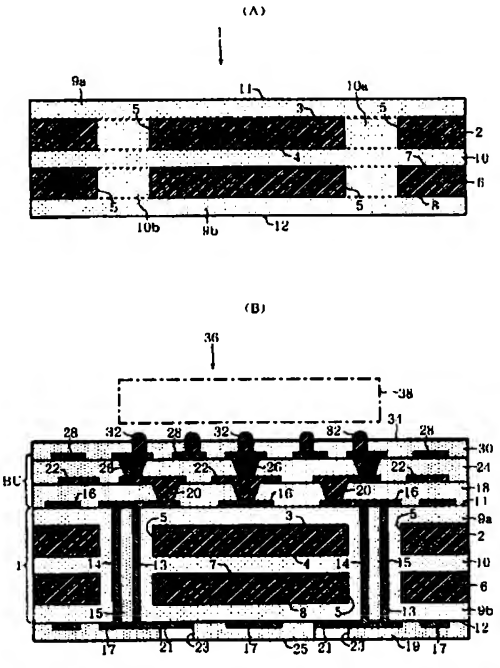
最終頁に続く

(54)【発明の名称】配線基板およびその製造方法

(57)【要約】
【課題】貫通孔の穿孔が容易で且つ平坦な表面や裏面を有するコア基板を含み所要の基板強度を有する配線基板とその製造方法を提供する。
【解決手段】表面３，７および裏面４，８を有し且つ互いに絶縁材１０を介して平行に配置した比較的薄肉の複数の金属板２，６と、かかる複数の金属板２，６における表面３，７と裏面４，８との間を貫通し且つ平面視で同じ位置に形成される貫通孔５，５と、かかる貫通孔５，６内に形成された絶縁材１０と、を含むコア基板１を備えている、配線基板３６。
【選択図】　図１



【特許請求の範囲】
【請求項１】
表面および裏面を有し且つ互いに絶縁層を介して平行に配置した複数の金属板と、
上記複数の金属板における表面と裏面との間を貫通する貫通孔と、
上記貫通孔内に形成された絶縁材と、を含むコア基板を備えている、
ことを特徴とする配線基板。
【請求項２】
前記貫通孔は、前記複数の金属板における平面視でほぼ同じ位置に形成されている、ことを特徴とする請求項１に記載の配線基板。
【請求項３】
前記コア基板の表面および裏面にそれぞれ外層絶縁層を介して個別に形成した表面配線層ならびに裏面配線層と、
上記表面配線層および裏面配線層の少なくとも一方の上方に形成され複数の絶縁層とこれらの間に位置する複数の配線層とからなるビルドアップ層と、
を更に含む、ことを特徴とする請求項１または２に記載の配線基板。
【請求項４】
表面および裏面を有する平行な複数の金属板の間に絶縁シートを挿入し且つ絶縁層として密着する工程と、
上記複数の金属板およびこれらの間に挟まれた上記絶縁層からなる積層体の厚み方向に沿って貫通孔を形成する工程と、
上記積層体の表面および裏面に外層絶縁シートをそれぞれ積層し且つこれらを厚み方向に沿って押圧して密着すると共に、上記貫通孔に絶縁材を充填する工程と、を備えるコア基板の製造工程を含む、
ことを特徴とする配線基板の製造方法。
【請求項５】
表面および裏面を有する複数の金属板における平面視で同じ位置に貫通孔を形成する工程と、
上記貫通孔を有する平行な上記複数の金属板の間に絶縁シートを挿入し且つこれらを厚み方向に沿って押圧することにより、複数の金属板の間に密着する絶縁層および上記貫通孔に充填した絶縁材を含む積層体を形成する工程と、
上記積層体の表面および裏面に外層絶縁シートをそれぞれ密着する工程と、
を備えるコア基板の製造工程を含む、ことを特徴とする配線基板の製造方法。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】
本発明は、金属板のコア材（芯材）を有するコア基板を用いた配線基板およびその製造方法に関する。
【０００２】
【従来の技術】
複数の絶縁層とこれらの間に位置する複数の配線層とを含む多層構造の配線基板には、樹脂製または樹脂－ガラス製の絶縁性を有するコア基板が用いられている。しかし、配線基板の強度を高め且つ反りなどの変形を防ぐため、例えば銅合金からなる金属板を有するコア基板も活用されている。
かかる金属製のコア基板６０は、図６（Ａ）に示すように、銅合金からなり且つ厚み０．２５ｍｍの金属板６２と、その表面６３と裏面６４との間を貫通する貫通孔６５と、かかる貫通孔６５内に充填された合成樹脂からなる絶縁材６６などとからなる。上記金属板６２の表面６３および裏面６４には、合成樹脂からなる絶縁層６６ａ，６６ｂが個別に形成されている。
【０００３】
配線基板の放熱性や、使用電流値および基板強度を重視する場合には、比較的厚肉の金属

板６２が使用される。しかしながら、図６（Ｂ）に示すように、かかる金属板６２の表面６３と裏面６４との間に貫通孔６５を穿孔する際、かかる貫通孔６５の軸方向の長さと内径との比（アスペクト比）が大きくなる。このため、ドリルなどによる貫通孔６５の正確な形成が困難になる、という問題があった。
一方、小型化および薄肉化に対応したり、内部を貫通するスルーホール導体におけるループインダクタンスの低減を重視する配線基板のコア基板６０においては、比較的薄肉の金属板６２が使用される。しかしながら、薄肉の金属板６２を有するコア基板６０を用いると、基板強度が低下する、という問題があった。
【０００４】
更に、図６（Ｃ）に示すように、コア基板６０の表面６７側のみ（片面）にビルドアップ層ＢＵを形成した配線基板７０は、以下のような構造を有する。
上記配線基板７０は、図６（Ｃ）に示すように、コア基板６０内の金属板６２の貫通孔６５内を、絶縁材６６を介して貫通するスルーホール７１内にスルーホール導体７２および充填樹脂７３を形成する。また、コア基板６０の表面６７と裏面６８とには、表面配線層７４と裏面配線層７５とが個別に形成される。更に、ビルドアップ層ＢＵは、樹脂からなる絶縁層７６，８２と、これらに間に形成した配線層８０，８６とを有し、配線層８０は、表面配線層７４とビア導体７８を介して接続され、配線層８０，８６間は、ビア導体８４により接続される。
【０００５】
図６（Ｃ）に示すように、絶縁層８２および配線層８６の上には、最上層の絶縁層（ソルダーレジスト層）８８が形成され、配線層８６上から立設する複数のハンダバンプ９２は、絶縁層８８を貫通し、その表面９０よりも高く突出している。また、図６（Ｃ）に示すように、コア基板６０の裏面６８および裏面配線層７５の下にも、絶縁層（ソルダーレジスト層）７９が形成され、その表面８１に開口する複数の開口部８３には、裏面配線層７５から延びた配線７７が位置している。
【０００６】
しかしながら、配線基板７０は、コア基板６０内の金属板６２が厚肉で貫通孔６５が長くなると、この内部に充填される絶縁材６６の量が増えるため、かかる貫通孔６５の真上および真下に位置するコア基板６０の表面６７や裏面６８に凹みが生じ、これらの上に形成される配線層７４などの平坦性が得られない、という問題がある。更に、貫通孔６５が長くなると、これを貫通するスルーホール導体７２のループインダクタンスが増加する、という問題がある。
加えて、ビルトアップ層ＢＵ側に樹脂が偏在し且つコア基板６０側に金属が偏在しているため、図６（Ｃ）中の一点鎖線で示すように、配線基板７０全体がビルドアップ層ＢＵ側に凹むような反りを生じ易くなる、という問題もあった。
【０００７】
【発明が解決すべき課題】
本発明は、以上において説明した従来の技術における問題点を解決し、貫通孔の穿孔が容易で且つ平坦な表面や裏面を有するコア基板を含み高い基板強度を有る配線基板およびその製造方法を提供する、ことを課題とする。
【０００８】
【課題を解決するための手段および発明の効果】
本発明は、上記課題を解決するため、コア基板に比較的薄肉の金属板を複数用いる、ことに着想して成されたものである。
即ち、本発明の配線基板（請求項１）は、表面および裏面を有し且つ互いに絶縁層を介して平行に配置した複数の金属板と、かかる複数の金属板における表面と裏面との間を貫通する貫通孔と、かかる貫通孔内に形成された絶縁材と、を含むコア基板を備えている、ことを特徴とする。
【０００９】
これによれば、比較的薄肉の複数の金属板を用いることができるため、それらの表面と裏

面との間に精度の良い貫通孔が形成されると共に、当該コア基板の強度を低下させず且つかかるコア基板を含む配線基板の強度も所望のレベルに保つことが容易となる。また、従来の１枚の金属板を有するコア基板やこれを含む配線基板に比べて、軽量化することも可能となる。更に、コア基板に比較的厚肉の１枚の金属板を用いる場合に比べて、貫通孔の形成時の加工性が向上する。

【００１０】

付言すると、上記複数の金属板の熱膨張率などの特性や厚みなどを相違させることにより、多層構造を有する配線基板の内部構造に起因する反りを抑制したり、解消することも容易な配線基板とすることも可能である。

尚、前記金属板には、Ｃｕ－２．３ｗｔ％Ｆｅ－０．０３ｗｔ％Ｐ（１９４アロイ）などの銅合金、純銅、無酸素銅、Ｆｅ－４２ｗｔ％Ｎｉ（４２アロイ）やＦｅ－３６ｗｔ％Ｎｉ（インバー）などのＦｅ－Ｎｉ系合金、その他の鋼種、チタンやその合金、およびアルミニウムやその合金などからなる板が含まれる。また、上記「比較的薄肉」とは、例えば従来の金属板の厚みＯ．２５ｍｍよりも薄いことを指す。

【００１１】

また、本発明には、前記貫通孔は、前記複数の金属板における平面視でほぼ同じ位置に形成されている、配線基板（請求項２）も含まれる。

これによれば、複数の金属板の貫通孔がほぼ同軸心で位置するため、これらの中心部に沿ってスルーホール導体を精度良く配置でき且つかかるスルーホール導体周りの絶縁性などの電気的特性を安定させることが可能となる。従って、所要の基板強度や平坦性を有し且つ信頼性の高い配線基板とすることが可能となる。

【００１２】

更に、本発明には、前記コア基板の表面および裏面に形成した表面配線層ならびに裏面配線層と、かかる表面配線層および裏面配線層の少なくとも一方の上方に形成される複数の絶縁層とこれらの間に位置する複数の配線層とからなるビルドアップ層と、を更に含む、配線基板（請求項３）も含まれる。

これによれば、所要の基板強度や平坦度を有する多層構造の配線基板とすることができる。尚、例えば、コア基板の表面の上方のみに上記ビルドアップ層を形成している片面構造の配線基板では、コア基板に含まれる複数の金属板の熱膨張率や厚みなどを相違させることにより、ビルドアップ層側が凹む反りを解消または抑制し、一層平坦な配線層や絶縁層を含むビルドアップ層や、平坦な表面および裏面配線層を有する信頼性の高い配線基板とすることも容易となる。

【００１３】

また、本発明は、前記コア基板の貫通孔内に前記表面配線層および裏面配線層を接続するスルーホール導体が形成されている、配線基板を含み得る。

これによる場合、上記スルーホール導体は、前記複数の金属板の貫通孔を絶縁材を介して貫通し、且つ表面配線層と裏面配線層との間の導通を確実に取ることができる。このため、コア基板の表面および裏面の少なくとも一方に形成されたビルドアップ層における複数の配線層を、コア基板の反対側の裏面配線層または表面配線層と導通させたり、コア基板を挟んだビルドアップ配線同士の導通を確実に取ることが可能となる。

【００１４】

一方、本発明における第１の配線基板の製造方法（請求項４）は、表面および裏面を有する平行な複数の金属板の間に絶縁シートを挿入し且つ絶縁層として密着する工程と、上記複数の金属板およびこれらの間に挟まれた上記絶縁層からなる積層体の厚み方向に沿って貫通孔を形成する工程と、上記積層体の表面および裏面に外層絶縁シートをそれぞれ積層し且つこれらを厚み方向に沿って押圧して密着すると共に、上記貫通孔に絶縁材を充填する工程と、を備えるコア基板の製造工程を含む、ことを特徴とする。

これによれば、複数の金属板に上記貫通孔を精度良く形成でき、且つかかる貫通孔に絶縁材を過不足なく充填できると共に、所要の強度を有するコア基板、およびこれを用いた所望の基板強度や平坦性を有し且つ電気的特性が安定し易い配線基板を確実に製造できる。

【００１５】
また、本発明における第２の配線基板の製造方法（請求項５）は、表面および裏面を有する複数の金属板における平面視で同じ位置に貫通孔を形成する工程と、上記貫通孔を有する上記複数の平行な金属板の間に絶縁シートを挿入し且つこれらを厚み方向に沿って押圧することにより、複数の金属板の間に密着する絶縁層および上記貫通孔に充填した絶縁材を含む積層体を形成する工程と、かかる積層体の表面および裏面に外層絶縁シートをそれぞれ密着する工程と、を備えるコア基板の製造工程を含む、ことを特徴とする。
これによっても、複数の金属板に上記貫通孔を精度良く形成し、かかる貫通孔に絶縁材を過不足なく充填すると共に、所要の強度のコア基板と、これを用いた平坦で電気的特性が安定し易い配線基板を確実に製造することが可能となる。

【００１６】
尚、本発明は、前記各工程の後で、上記積層体の貫通孔内で且つ上記絶縁層、表面絶縁層、および裏面絶縁層を貫通するスルーホールおよびスルーホール導体を形成する工程を有する、配線基板の製造方法も含み得る。
これによる場合、複数の金属板の貫通孔の中心部に沿ってスルーホール導体を精度良く配置できるため、所要の基板強度を有し且つ上記スルーホール導体周りの絶縁性などの電気的特性に優れた配線基板を製造することが可能となる。

【００１７】
【発明の実施の形態】
以下において、本発明の実施に好適な形態を図面と共に説明する。
図１（Ａ）は、本発明における１形態のコア基板１の断面を示す。
コア基板１は、図１（Ａ）に示すように、一対（複数）の金属板（コア材）２，６と、これらの間に介在する絶縁層１０と、金属板２，６の表面３，７と裏面４，８との間を貫通する複数の貫通孔５と、かかる貫通孔５内に充填された絶縁材１０ａ，１０ｂと、金属板２の表面３に形成された表面絶縁層（外層絶縁層）９ａと、金属板６の裏面８に形成された裏面絶縁層（外層絶縁層）９ｂと、を有する。
上記金属板２，６は、Ｃｕ－２．３ｗｔ％Ｆｅ－０．０３ｗｔ％Ｐ（１９４アロイ）の銅合金からなり、その厚みは０．１ｍｍと従来に比べて比較的薄肉である。

【００１８】
また、上記貫通孔５は、断面円形で且つその内径は約０．３ｍｍであり、上記金属板２，６をパンチング、ドリル、またはエッチングして形成される。複数の貫通孔５，５は、図１（Ａ）に示すように、平面視で同じ位置に形成されている。　更に、上記絶縁層１０、絶縁材１０ａ，１０ｂ、表面絶縁層９ａ、および裏面絶縁層９ｂは、例えばエポキシ樹脂からなる。このうち、絶縁層１０および表面・裏面絶縁層９ａ，９ｂの厚みは、約２０～４０μｍである。
即ち、図１（Ａ）に示すコア基板１は、その表面１１と裏面１２との間における全体の厚みが約０．３ｍｍであり、上記貫通孔５の加工性が向上する。

【００１９】
以上のようなコア基板１によれば、比較的薄肉の一対の金属板２，６、これらの間に配置した絶縁層１０、および上記金属板２，６の表面３・裏面８に形成された表面・裏面絶縁層９ａ，９ｂからなる積層構造であるため、従来のような単一の金属板６２を用いたコア基板６０に比べて強度が低下しない。また、比較的薄肉の金属板２，６には、内壁が平滑な貫通孔５が形成されているため、かかる貫通孔５，５内に絶縁材１０ａ，１０ｂが過不足なく充填される。しかも、貫通孔５，５に充填される絶縁材１０ａ，１０ｂの量が従来よりも減るため、その真上や真下のコア基板１の表面１１や裏面１２に凹みが生じにくくなり、これらの上方に追って形成される配線層や絶縁層を平坦にして形成することができる。

【００２０】
図１（Ｂ）は、前記コア基板１を用いた配線基板３６の断面を示す。
配線基板３６は、図１（Ｂ）に示すように、コア基板１と、その貫通孔５，５内に位置す

る絶縁材１０ａ，１０ｂの中心部などを貫通するスルーホール１３およびその内壁に沿ったスルーホール導体１４と、コア基板１の表面１１と裏面１２に個別に形成された表面配線層１６，裏面配線層１７と、を含む。尚、前記金属板２，６は、表面配線層１６や裏面配線層１７と図示しないビア導体を介して導通することにより、電源またはグランド層として使用することもできる。
上記スルーホール導体１４は、外径が約１５０μｍで且つ厚みが約２０μｍであり、その上・下端で表面配線層１６および裏面配線層１７と接続している。かかる表面配線層１６および裏面配線層１７は、所定パターンを有し且つ厚みが約１０～４０μｍの銅メッキ膜からなる。

【００２１】

また、図１（Ｂ）に示すように、コア基板１の表面１１および表面配線層１６の上方には、絶縁層１８，２４およびこれらの間や表面に形成された配線層２２，２８からなるビルドアップ層ＢＵが形成されている。上記絶縁層１８，２４は、厚みが３０μｍでシリカフィラなどの無機フィラを含むエポキシ樹脂フィルムからなる。また、上記配線層２２，２８は、所定パターンを有し且つ厚みが上記同様の銅メッキ膜からなる。かかる配線層２２，２８間や表面配線層１６と配線層２２との間は、銅メッキからなるビア導体（フィルドビア）２０，２６を介して接続される。上記絶縁層２４および配線層２８の上には、厚みが２０μｍの絶縁層（ソルダーレジスト層）３０が形成される。

【００２２】

更に、図１（Ｂ）に示すように、上記配線層２８の適所からは、絶縁層３０を貫通し且つその表面である第１主面３４よりも高く複数のハンダバンプ３２が突出している。ハンダバンプ３２は、Ｓｎ－Ａｇ系、Ｐｂ－Ｓｎ系、Ｓｎ－Ａｇ－Ｃｕ系、Ｓｎ－Ｃｕ系、Ｓｎ－Ｚｎ系など（本実施形態ではＳｎ－Ａｇ系）の低融点合金からなり、第１主面３４上に実装されるＩＣチップ（電子部品）３８の図示しない接続端子と個別に接続される。また、ハンダバンプ３２とＩＣチップ３８の接続端子とは、図示しないアンダーフィル材により埋設され且つ保護される。

【００２３】

一方、図１（Ｂ）に示すように、コア基板１の裏面１２および裏面配線層１７の下方（上方）には、前記同様の絶縁層（ソルダーレジスト層）１９が形成され、かかる絶縁層１９において第２主面２５側に開口する開口部２３の底面には、裏面配線層１７から延びた配線２１が位置する。かかる配線２１は、その表面にＮｉメッキおよびＡｕメッキが被覆され、図示しなマザーボードなどのプリント基板との接続端子として活用される。

【００２４】

以上のような配線基板３６では、コア基板１には比較的薄肉で一対の金属２，６が平行に配置されいるため、従来同様の基板強度を有すると共に、貫通孔５が精度良く形成されているため、その内部に絶縁材１０ａ，１０ｂを密にして充填され且つスルーホール導体１４の周囲を確実に絶縁できる。また、コア基板１の表面１１が平坦であるため、この上方に形成される表面配線層１６などや絶縁層１８などの平坦性も確保し易くなる。更に、比較的薄肉の金属２，６を含む薄いコア基板１をスルーホール導体１４が貫通しているため、従来の厚い１枚の金属板を用いる場合に比べ、かかるスルーホール導体１４の長さが数１０μｍほど短くなる。この結果、スルーホール導体１４を流れる電流によるループインダクタンスを低減して、電気的特性を安定させることができる。従って、従来と同様の強度を有し且つ軽量化も可能であり、内部配線などが平坦で電気的特性が安定し易い配線基板３６となる。

【００２５】

以下において、前記配線基板３６の製造方法について説明する。
図２は、本発明における第１の配線基板３６の製造方法（請求項４）に関する。　図２（Ａ）は、前記銅合金からなり厚みが０．１ｍｍの一対の金属板２，６の裏面４と表面７との間に、厚みが６０μｍの絶縁シートＳを挿入し且つこれらの厚み方向に沿ってプレスして密着させた工程を示す。上記絶縁シートＳには、例えばエポキシ樹脂からなるドライタ

イプのフイルムが用いられる。
次に、図２（Ｂ）に示すように、金属板２，６および絶縁シートＳからなる積層体との厚み方向に沿って、ドリルまたはパンチングにより内径が０．３ｍｍの貫通孔５，ｈを複数形成する工程を行う。この際、金属板２，６は、それぞれの厚みが０．１ｍｍと薄肉であるため、これらを貫通する上記貫通孔５，ｈは、その位置精度が良く且つその内壁が比較的平滑な切削面または破断面となる。
【００２６】
次いで、図２（Ｃ）に示すように、複数の貫通孔５，ｈを有する金属板２，６および絶縁シートＳからなる積層体の表面３と裏面８とに、厚みが６０μｍの前記同様の外層絶縁シートＳ１，Ｓ２を個別に積層する。そして、図２（Ｃ）中の矢印で示すように、金属板２，６、絶縁シートＳ、および外層絶縁シートＳ１，Ｓ２を、厚み方向に沿ってホットプレスなどにより加熱しつつ押圧する工程を行う。　尚、かかる工程の後で、上記絶縁シートＳ，Ｓ１，Ｓ２を加熱して硬化させる公知の硬化（キュア）処理が施される。
その結果、図２（Ｄ）に示すように、上記絶縁シートＳ，Ｓ１，Ｓ２は、厚み方向で圧縮され、且つそれらの一部は金属板２，６の貫通孔５，５内に圧入して充填され、絶縁材１０ａ，１０ｂになる。同時に、上記絶縁シートＳ，Ｓ１，Ｓ２は、互いに一体に接続された絶縁層１０と表面・裏面絶縁層９ａ，９ｂとなって、図２（Ｄ）に示すように、金属板２，６を内蔵する前記コア基板１が得られる。　かかるコア基板１では、複数の貫通孔５に充填される絶縁材１０ａ，１０ｂが減るため、その真上や真下の表面１１および裏面１２に凹みが生じにくくなる。即ち、貫通孔５の長さが短く樹脂の硬化収縮が小さいため、凹みが少なくなる。
【００２７】
図３は、本発明における第２の配線基板３６の製造方法（請求項５）に関する。　図３（Ａ）は、前記銅合金からなり且つ前記と同じ厚みの金属板２，６に、平面視における表面３，７と裏面４，８との間の同じ位置に内径０．３ｍｍの貫通孔５を複数パンチングにより形成した工程を示す。かかる金属板２，６は、それぞれ比較的薄肉であるため、これらを貫通する上記貫通孔５は、その位置精度が良く且つその内壁が比較的平滑な打ち抜き面となる。
次に、図３（Ｂ）に示すように、貫通孔５が形成された金属板２，６の裏面４と表面７との間に、厚みが８０μｍの絶縁シートＳを挿入し、同図中の矢印で示すように、これらの厚み方向に沿ってホットプレスにより押圧する工程を行う。
【００２８】
その結果、図３（Ｃ）に示すように、絶縁シートＳは薄くなり、同時にその一部Ｓａ，Ｓｂは金属板２，６の貫通孔５，５内に圧入され且つこれらをほぼ満たす。これにより、金属板２，６および絶縁シートＳは、密着した積層体となる。
次いで、図３（Ｄ）に示すように、金属板２，６および絶縁シートＳからなる積層体の表面３と裏面８とに、厚みが４０μｍの前記同様の外層絶縁シートＳ１，Ｓ２を個別に積層する。そして、図３（Ｄ）中の矢印で示すように、金属板２，６、絶縁シートＳ、および外層絶縁シートＳ１，Ｓ２を、厚み方向に沿ってホットプレスにより加熱しつつ押圧する工程を行う。その後で、上記絶縁シートＳ，Ｓ１，Ｓ２を加熱して硬化させる公知の硬化（キュア）処理が施される。その結果、前記図１（Ａ）および２（Ｄ）に示したと同様なコア基板１を得ることができる。
【００２９】
前記第１または第２の製造方法により得られたコア基板１における金属板２，６の貫通孔５，５の中心部およびこれらの間に位置する絶縁層１０や上下の表面・裏面絶縁層９ａ，９ｂの厚み方向に沿って、ドリルまたはレーザ加工を行う。　その結果、図４（Ａ）に示すように、金属板２，６の貫通孔５，５の中心部に沿って、内径が約１５０μｍのスルーホール１３が形成される。
上記スルーホール１３の内壁とコア基板１の表面１１および裏面１２の全面とに、Ｐｄなどのメッキ触媒を被覆し且つ無電解銅メッキおよび電解銅メッキを施す。その結果、図４

（Ｂ）に示すように、スルーホール１３の内壁に沿って厚みが約２０μｍでほぼ円筒形のスルーホール導体１４が形成されると共に、コア基板１の表面１１および裏面１２の全面に銅メッキ膜１１ａ，１２ａが形成される。

【００３０】

次に、図４（Ｃ）に示すように、上記スルーホール導体１４の内側に非導電性または導電性で且つ無機フィラを含む充填樹脂１５を充填する。また、上記充填樹脂１５の上・下端を銅メッキして蓋メッキする。

次いで、上記銅メッキ膜１１ａ，１２ａの上に、所定のパターンを有する図示しないエッチングレジストをそれぞれ形成し、かかるレジストの隙間から露出する銅メッキ膜１１ａ，１２ａを公知の方法によりエッチングする。

その結果、図４（Ｃ）に示すように、コア基板１の表面１１と裏面１２とには、上記パターンに倣った表面配線層１６と裏面配線層１７とが形成され、これらはスルーホール導体１４を介して互いに接続される。

【００３１】

これ以降は、コア基板１の表面１１および表面配線層１６の上方に、前記ビルドアップ層ＢＵを形成する絶縁層１８，２４、ソルダーレジスト層３０、配線層２２，２８、フィルドビア導体２０，２６を公知のビルドアップ工程（セミアディティブ法、フルアディティブ法、サブトラクティブ法、フィルム状樹脂材料のラミネートによる絶縁層の形成、フォトリソグラフィ技術など）により形成する。　また、前記ハンダバンプ３２を配線層２８上の適所に形成する。

【００３２】

更に、コア基板１の裏面１２および裏面配線層１７の上方（下方）に、前記ソルダーレジスト層１９を形成し、これにレーザ加工を施して前記開口部２３を形成し且つその底面に配線２１を露出させ、その表面に前記メッキを施す。

この結果、前記図１（Ｂ）に示した本発明の配線基板３６を得ることができる。　以上のような本発明における第１および第２の配線基板３６の製造方法によれば、前記コア基板１を用い且つ所要の基板強度および平坦度を有し電気的特性が安定し易い配線基板３６を確実に提供することができる。

尚、コア基板１の裏面１２および裏面配線層１７の上方にも、前記と同様なビルドアップ層ＢＵを対称に形成しても良い。

【００３３】

図５（Ａ）は、前記コア基板１の応用形態であるコア基板１ａの断面を示す。

コア基板１ａは、図５（Ａ）に示すように、前記銅合金からなり且つ互いに平行に配置された厚みが０．１２ｍｍの金属板２ａおよび厚みが０．０８ｍｍの金属板６ａと、これらの間に位置する前記と同じ絶縁層１０とを含む。

また、図５（Ａ）に示すように、上記金属板２ａ，６ａの表面３，７と裏面４，８との間で平面視で同じ位置を貫通する前記同様の複数の貫通孔５内には、前記と同じ絶縁材１０ａ，１０ｂが充填され、金属板２ａの表面３と金属板６ａの裏面８にも前記と同じ表面絶縁層９ａや裏面絶縁層９ｂが形成されている。かかるコア基板１ａも前記第１または第２の製造方法により得ることができる。

【００３４】

上記コア基板１ａによっても、前記同様の強度や平坦性などが得られる。しかも、コア基板１ａの表面１１寄りに相対的に厚肉の金属板２ａを配置しているため、当該コア基板１ａの表面１１の上にのみ（片面にのみ）前記ビルドアップ層ＢＵを形成した前記配線基板３６と同様な配線基板としても、当該ビルドアップ層ＢＵ側が凹むような反りをなくすか、抑制することも可能となる。

尚、同じ厚みの金属板２，６を用いた前記コア基板１においても、かかるコア基板１の表面１１寄りの金属板２の熱膨張率を、裏面１２寄りの金属板６の熱膨張率よりも大きいものを選定することによっても、上記反りを防止可能となる。

【００３５】

図５（Ｃ）は、異なる形態のコア基板４０の断面を示す。
コア基板４０は、図５（Ｃ）に示すように、前記銅合金からなり且つ互いに平行に配置された厚みが０．０８ｍｍの金属板４１，４４，４７と、これらの間に配置された絶縁層５１，５２と、を含む。金属板４１，４４，４７には、表面４２，４５，４８と裏面４３，４６，４９との間を、平面視で同じ位置において複数の貫通孔５０が同軸心に貫通している。また、各貫通孔５０内には、前記同様の絶縁材が充填され、且つ最上層の金属板４１の表面４２と最下層の金属板４７の裏面４９には、表面絶縁層（外層絶縁層）５３と裏面絶縁層（外層絶縁層）５４とが個別に形成されている。かかるコア基板４０の表面５５と裏面５６との間における全体の厚みは、前記コア基板１，１ａの厚みとほぼ同様である。
以上のようなコア基板４０も前記第１または第２の製造方法により得ることができ、前記コア基板１と同様な効果が得られると共に、前記配線基板３６と同様な配線基板を形成することが可能である。

【００３６】

図５（Ｃ）は、上記コア基板４０の応用形態たるコア基板４０ａの断面を示す。　コア基板４０ａは、図５（Ｃ）に示すように、前記銅合金からなり互いに平行に配置された３枚の金属板４１ａ，４４，４７ａを含む。最上層の金属板４１ａの厚みは０．１０ｍｍ、中層の金属板４４の厚みは０．０８ｍｍ、最下層の金属板４７ａの厚みは０．０５ｍｍである。金属板４１ａ，４４，４７ａ間には、前記と同様の絶縁層５１，５２が位置し、これらの表面４２，４５，４８と裏面４３，４６，４９との間には、前記同様の貫通孔５０が形成される。
更に、最上層の金属板４１ａの表面４２と最下層の裏面４９には、前記と同じ表面絶縁層５３と裏面絶縁層５４とが個別に形成されている。

【００３７】

上記コア基板４０ａによっても、前記同様の強度や平坦性などが得られる。しかも、コア基板４０ａの表面５５寄りほどに相対的に厚肉の金属板４１ａを配置し且つ裏面５６寄りほどに相対的に薄肉の金属板４７ａを配置しているため、当該コア基板４０ａの表面５５の上にのみ（片面にのみ）前記ビルドアップ層ＢＵを形成した前記配線基板３６と同様な配線基板としても、かかるビルドアップ層ＢＵ側が凹むような反りをなくすか、抑制することも可能となる。
尚、同じ厚みの金属板４１，４４，４７を用いた前記コア基板４０においても、かかるコア基板４０の表面５５寄りの金属板４１の熱膨張率を、裏面５６寄りの金属板４７の熱膨張率よりも大きくし、且つ中層の金属板４４の熱膨張率をこれらの中間のものに選定することによっても、上記反りを防止可能となる。

【００３８】

本発明は、以上において説明した各形態に限定されるものではない。
各形態における金属板２，６などには、前記銅合金のほか、純銅、無酸素銅、Ｆｅ－４２ｗｔ％ＮｉやＦｅ－３６ｗｔ％ＮｉなどのＦｅ－Ｎｉ系合金、その他の鋼種、チタンやその合金、およびアルミニウムやその合金も適用可能である。且つ、コア基板１などには、４枚以上の金属板を併用することも可能である。
また、前記絶縁層１０などや表面・裏面絶縁層９ａ，９ｂなどになる絶縁材には、連続多孔質ＰＴＦＥにエポキシ樹脂を含浸した複合材のプリプレグなどを適用することも可能である。
更に、ビルドアップ層ＢＵの絶縁層１８などには、前記エポキシ樹脂を主成分とするもののほか、同様の耐熱性、パターン成形性等を有するポリイミド樹脂、ＢＴ樹脂、ＰＰＥ樹脂、あるいは、連続気孔を有するＰＴＦＥなど３次元網目構造のフッ素系樹脂にエポキシ樹脂などの樹脂を含浸させた樹脂－樹脂系の複合材料などを用いることもできる。尚、絶縁層の形成には、絶縁性の樹脂フィルムを熱圧着する方法のほか、液状の樹脂をロールコータにより塗布する方法を用いることもできる。尚また、絶縁層に混入するガラス布またはガラスフィラの組成は、Ｅガラス、Ｄガラス、Ｑガラス、Ｓガラスの何れか、またはこれらのうちの２種類以上を併用したものとしても良い。

【００３９】
また、表面配線層１６やビルドアップ層ＢＵの配線層２２などには、前記Ｃｕ（銅）の他、Ａｇ、Ｎｉ、Ｎｉ－Ａｕ系などにしても良く、あるいは、これら金属のメッキ層を用いず、導電性樹脂を塗布するなどの方法により形成しても良い。　更に、前記フィルドビア導体２０などに替えて、絶縁層１８などに形成するビアホール内部が完全に導体で埋まっていない逆円錐形状のコンフォーマルビア導体を用いることもできる。あるいは、各ビア導体の軸心をずらしつつ積み重ねるスタッガードの形態でも良いし、途中で平面方向に延びる配線層が介在する形態としても良い。

【図面の簡単な説明】

【図１】（Ａ）は本発明の配線基板に用いるコア基板の１形態を示す断面図、（Ｂ）はかかるコア基板を用いた本発明の配線基板を示す断面図。

【図２】（Ａ）～（Ｄ）は第１の配線基板の製造方法の各工程を示す概略図。

【図３】（Ａ）～（Ｄ）は第２の配線基板の製造方法の各工程を示す概略図。

【図４】（Ａ）～（Ｃ）は上記各製造方法の末尾の工程に続く各工程を示す概略図。

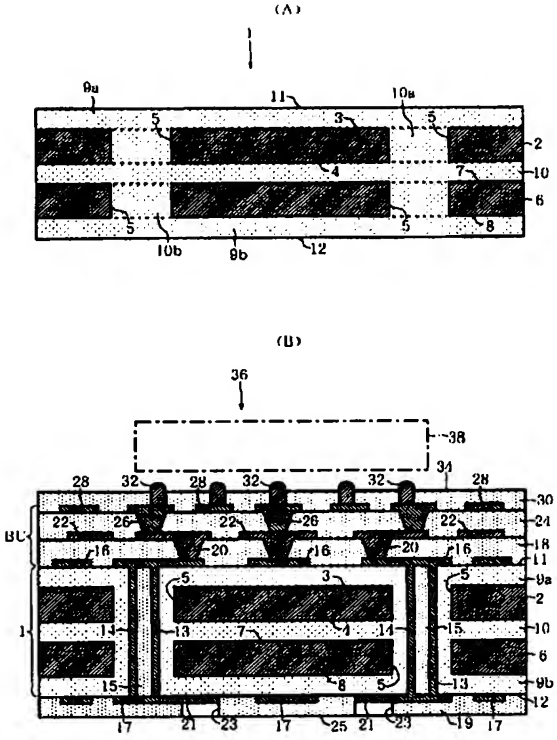
【図５】（Ａ）は図１（Ａ）のコア基板の応用形態を示す断面図、（Ｂ）は異なる形態のコア基板を示す断面図、（Ｃ）は（Ｂ）のコア基板の応用形態を示す断面図。

【図６】（Ａ）は従来のコア基板を示す断面図、（Ｂ）はこれに用いた金属板を示す断面図、（Ｃ）は（Ａ）のコア基板を用いた従来の配線基板を示す断面図。

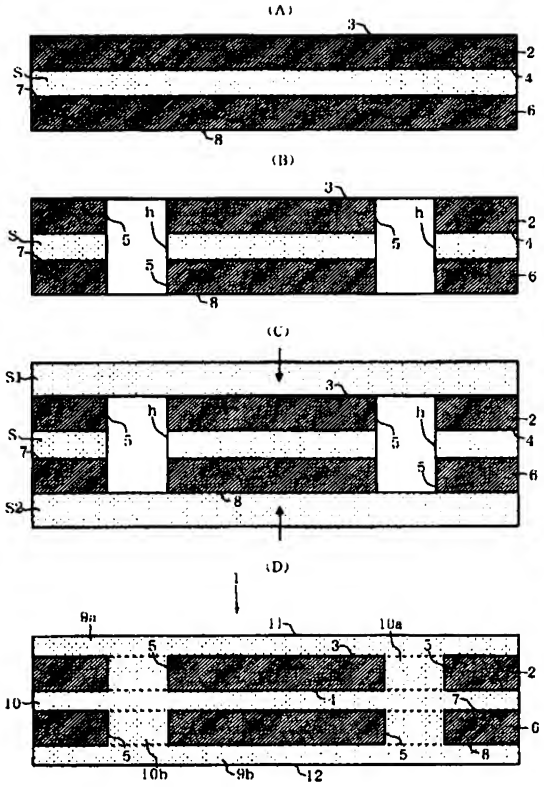
【符号の説明】

１，１ａ，４０，４０ａ……コア基板
２，２ａ，６，６ａ，４１，４４，４７…金属板
３，７，４２，４５，４８……金属板の表面
４，８，４３，４６，４９……金属板の裏面
５，５０……貫通孔
９ａ，５３……表面絶縁層（外層絶縁層）
９ｂ，５４……裏面絶縁層（外層絶縁層）
１０，５１，５２……絶縁層
１０ａ，１０ｂ……絶縁材
１１，５５……コア基板の表面
１２，５６……コア基板の裏面
１６……表面配線層
１７……裏面配線層
１８，２４……絶縁層
２２，２８……配線層
３６……配線基板
ＢＵ……ビルドアップ層
Ｓ……絶縁シート
Ｓ１，Ｓ２……外層絶縁シート
ｈ……貫通孔

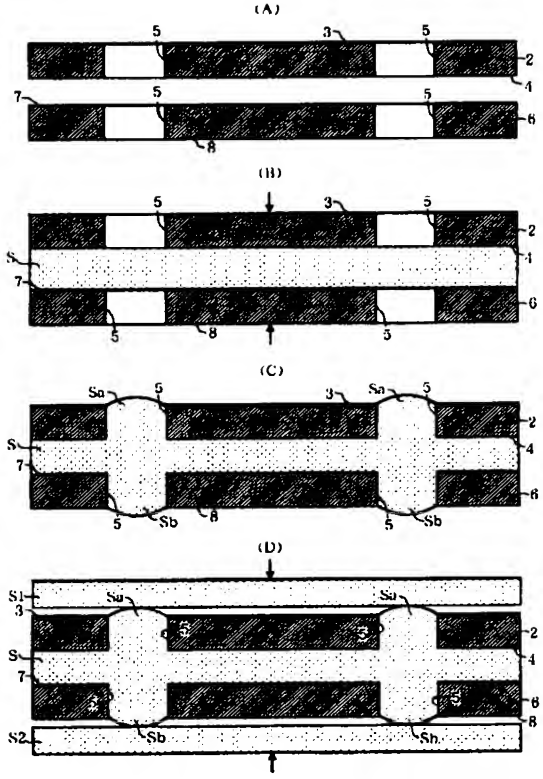
【図１】



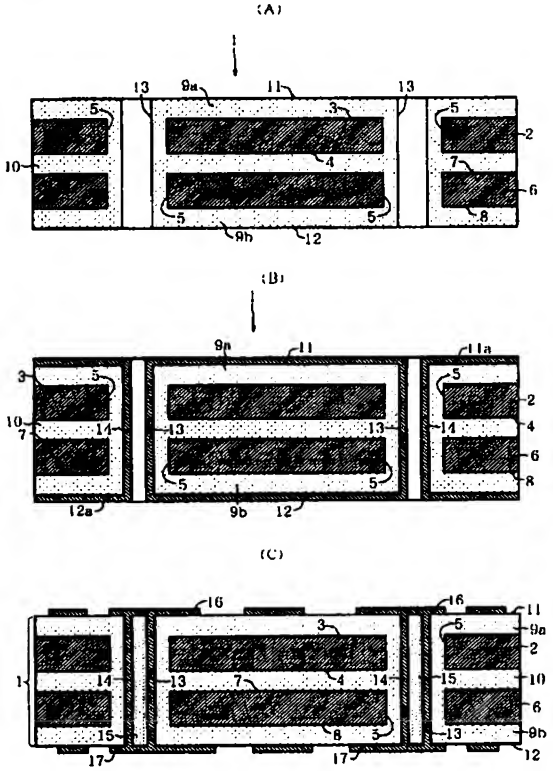
【図２】



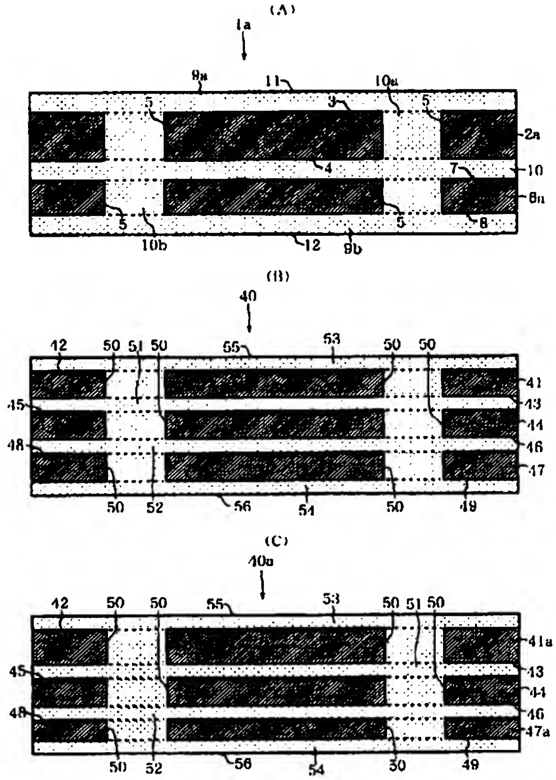
【図３】



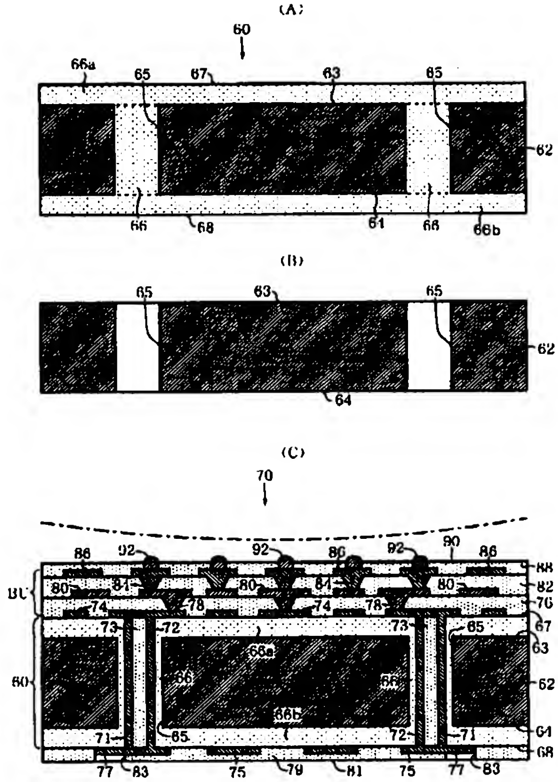
【図４】



【図５】


(A)
1a
9a
11
10a
5
3
2a
4
7
10
6a
8
10b
12
9b
(B)
40
42
50
51
55
53
41
43
44
45
46
47
48
52
56
54
49
(C)
40a
41a
47a

【図６】


(A)
60
66a
65
67
63
62
66
68
61
66b
(B)
64
(C)
70
BU
60

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